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Insufficient Physical Activity Among Adults and Human Development Index: A Global Study

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Abstract

Background: Insufficient physical activity, particularly in low- and middle-income countries, plays an important role in the spread of non-communicable diseases.
Objectives: The purpose of this study is to investigate the insufficient physical activity and its relationship with the human development index (HDI) in the world.
Methods: This is an ecological study, and the study data, including the human development index and the incidence of insufficient physical activity, were extracted from the World Bank's database. The descriptive analysis included mean and standard deviation. The inferential analysis consisted of two-way correlation and ANOVA at a significance level of less than 0.05. The analyses were performed using Stata-14 software.
Results: The highest insufficient physical activity in both sexes (39.26 [37.42, 40.95]) was found in the Americas, especially in high-income regions. There was a significant positive correlation between the incidence of insufficient physical inactivity and HDI in the world ($r = 0.446$, $P < 0.0001$). This correlation was also significant in Asia and Africa ($P < 0.05$). The results showed a positive correlation between components of HDI (i.e., gross national income per 1000 capita, mean years of schooling, life expectancy at birth, and expected years of schooling) and insufficient activity ($P < 0.0001$). The results of ANOVA also exhibited a significant relationship between the mean prevalence of physical inactivity and the level of development ($P < 0.0001$).
Conclusions: Given the significant correlation between the incidence of insufficient physical inactivity and HDI, understanding this correlation and its components, especially in low- and middle-income countries can alleviate the impact of physical inactivity epidemics in the future, thereby contributing to the effective global prevention of non-communicable diseases.

Keywords: Prevalence, Insufficient Physical Activity, Human Development Index, World

1. Background

Regular physical activity is recognized as a major health indicator of populations. Each year, two million lives are lost due to insufficient physical activity (IPA) worldwide (1, 2). A comparative risk assessment by the Global Burden of Disease suggested that IPA accounted for 3.2 million deaths, and 2.8% of years lived with disability in 2010. It is also ranked tenth among the top 20 risk factors attributable to the burden of diseases (3). Evidence suggests that 30 min of moderate-intensity exercise each day (equivalent to 4.2 MJ/wk or 1000 kcal/wk) is associated with a significant drop in cardiovascular diseases (4). Research has shown the link between physical activity and the risk of stroke. Many studies suggest that physical activity can decrease the risk of stroke by about 25% - 30% in active individuals (5).

Given the strong relationship between physical activity and major non-communicable diseases, one of the nine goals set by WHO member states for improving, preventing, and treating non-communicable diseases is to achieve 10% reduction in the incidence of IPA by 2025 (6).

Globally, many adults and children have inadequate physical activities to maintain their health (2, 7). The prevalence of IPA is growing at a slow pace and is even deteriorating in some countries (8). Risk factors, including the noncommunicable diseases induced by IPA are also on the rise in low-income countries in addition to developed countries. Understanding the behavioral causes of physical activity is crucial for progress and public health interventions (9).

Studies have exhibited that demographic and biological variables are significantly correlated with physical activity, and there is a positive correlation between physical activity and socioeconomic status in low- and middle-income countries (10-13).

IPA plays a key role in the spread of non-communicable diseases in high-income countries, and its impact is increasing in low- and middle-income countries. Hence, deeper insights into the causes of physical inactivity can have a huge influence on evidence-based planning for public health interventions because these programs target the main contributors of IPA (9). Therefore, the purpose of this study is to investigate the incidence of IPA in the world and its association with human development index (HDI).

2. Objectives

The purpose of this study is to investigate the insufficient physical activity and its relationship with HDI in the world.

3. Methods

The estimates are based on self-reported physical activity data derived from the Global Physical Activity Questionnaire (GPAQ), the International Physical Activity Questionnaire (IPAQ), or similar questionnaires that cover activities at workplace/home, transportation, and leisure time. Where necessary, the reported definition was modified (if different from the indicator's definition) to know the overreporting of activities in the IPAQ, to survey coverage (of the survey only covered urban areas), and to account for age coverage (in case the age range was narrower than 18+ years). No estimates are offered for countries for which no data was available (14).

3.1. Method of Estimation of Global and Regional Aggregates

We have offered global estimates as well as estimates of WHO regions and the World Bank's income groups. The estimates of countries were combined in each group and weighed by the population size of each country. Countries with no estimate were excluded from the analysis. We also used the World Bank's 2010 income groups report, as 2010 represented the estimation year (14).

3.2. Definition

The percentage of a specific population performing less than 150 min of moderate-intensity physical activity per week, or less than 75 min of moderate-intensity physical activity per week, or an equivalent combination (14).

3.3. Human Development Index (HDI)

With a numerical value between 0 and 1, HDI exhibits the extent of a country's progress in achieving the highest value (HDI = 1), which allows inter-country comparisons. In other words, HDI is a summary measure of the average achievement in three dimensions of human development, including a long and healthy life, schooling, and decent standards of living. HDI is the geometric mean of the normalized indices for each of these three dimensions and measures the degree of achievements in each dimension. Life expectancy is measured by life expectancy at birth, education is measured by mean years of schooling (elementary, secondary, and higher education), and standard of living is measured by gross national income (GNI) per capita (15, 16) .

3.4. Statistical Analysis

In this study, data analysis was conducted using Stata software (Ver. 14). The descriptive analysis involved mean and standard deviation. The correlation method was used to evaluate the association between the IPA and the HDI components. The significance level was set to 0.05.

4. Results

According to the results, the highest prevalence of IPA in both sexes (39.26, CI95% [37.42, 40.95]) in men (33.14, CI95% [30.82, 34.01]) and women (45.15, CI95% [42.87, 48.58]) was observed in the Americas (Table 1).

The highest incidence of IPA in both sexes was reported in Kuwait (69.66%), Saudi Arabia (53.14%), and Iraq (52.03%) in Asia, Brazil (47.02%), Costa Rica (46.06%) and Suriname (44.43%) in the Americas, Cyprus (44.35%), Portugal (43.4%)„ and Germany (42.21%) in Europe; Mauritania (41.31%), Mali (40.42%), and South Africa (38.17%) in Africa, and New Zealand (42.38%) in Oceania. (Table 2 and Figure 1).

According to the results, the highest incidence of IPA was reported in high-income areas. This figure was 41.58% for women, 32% for men, and 36.76% for both sexes. The lowest incidence of IPA (in women, men, and both sexes) was observed in low-income areas (Figure 2).

Table 1. Prevalence of IPA According to WHO (Source: WHO)

WHO	IPA Among Adults Aged ≥ 18 Years		
	Both Sexes	Male	Female
Africa	22.1 (19.92, 24.01)	18.4 (15.81, 20.9)	25.63 (22.82, 28.18)
Americas	39.26 (37.42, 40.95)	33.14 (30.82, 34.01)	45.15 (42.87, 48.58)
South-East Asia	30.49 (21.57, 46.84)	22.9 (15.09, 49.79)	38.62 (27.04, 63.96)
Europe	29.37 (27.91, 32.14)	26.17 (23.88, 29.54)	32.4 (30.52, 36.99)
Eastern Mediterranean	34.92 (32.14, 39.21)	26.94 (25.35, 30.56)	43.48 (41.36, 46.55)
Western Pacific	18.64 (16.53, 23.5)	18.8 (16.31, 25.13)	18.49 (15.54, 27.28)

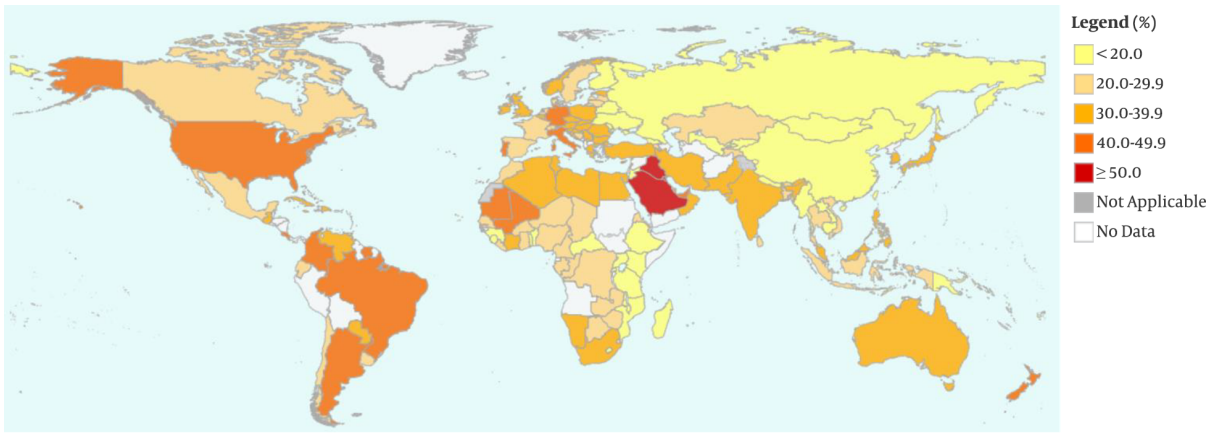
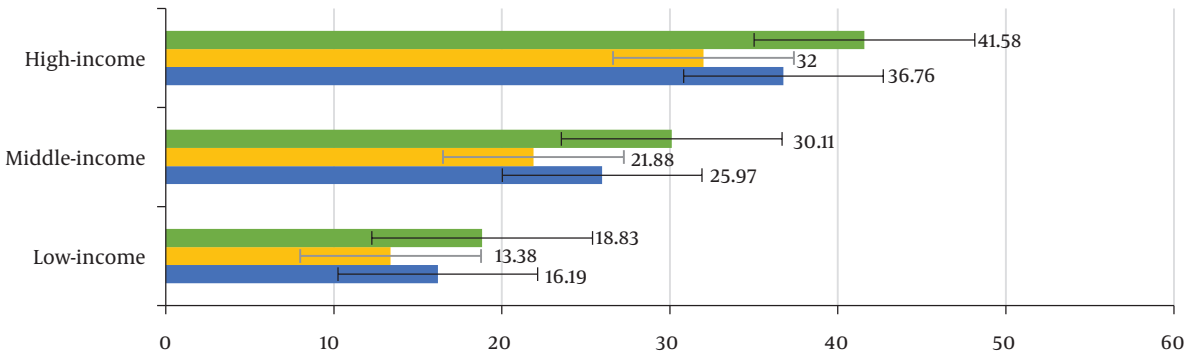


Figure 1. Prevalence of IPA among adults aged ≥ 18 years (age-standardized estimate) (%) in both sexes in 2016 [Source WHO]



	Low-income	Middle-income	High-income
Female	18.83	30.11	41.58
Male	13.38	21.88	32
Both	16.19	25.97	36.76

Figure 2. Prevalence of IPA among adults aged 18+ years (%) by income (Source: WHO)

The results exhibited a significant positive correlation between the incidence of IPA and HDI in the world (r = 0.446, P < 0.0001). According to the results, there was also a significant positive correlation between the prevalence

of IPA and the HDI in Asia (r = 0.334, P < 0.05) and Africa (r = 0.446). But the correlation observed was not significant in the Americas and Europe (P > 0.05; Figure 3).

The results indicated that the prevalence of IPA in both sexes was positively correlated with GNI (r = 0.410, P < 0.0001), MYS (r = 0.304, P < 0.0001), LEB (r = 0.418, P < 0.0001),, and EYS (r = 0.315, P < 0.0001) (Table 3).

The results of the analysis of variance (ANOVA) showed that the highest mean prevalence of IPA in both sexes (35.5 ± 1.09) belonged to countries with very high human development and the lowest (20.3 ± 9.6) to countries with low human development, and their difference was statistically significant (P < 0.0001). The highest mean prevalence of IPA in men (30.24 ± 8.7) belonged to countries with very high human development and the lowest (16.7 ± 8.4) to countries with low human development, and their difference was statistically significant (P < 0.0001). In women, the highest mean prevalence of IPA (37.05 ± 12.1) was associated with very high human development and the lowest (23.79 ± 11.1) with low human development, and their difference was statistically significant (P < 0.0001; Table 4).

5. Discussion

Physical activity represents an integral part of different facets of daily life, including work, transportation, and leisure. This distinction is particularly relevant in the developing countries that are in a state of transition, where recreational and leisure activities account for a lower share of total costs compared to occupational or transport activities (17). Measuring the level of physical activity in the population is essential for health promotion and policy formulation as well as the assessment of the impact of large-scale policies and programs designed to amplify activity (18).

As noted by the results of this study, the highest prevalence of physical inactivity was observed in high-income regions (41.58% in men and 32% in women) and the lowest prevalence of physical inactivity (in women, men, and both sexes) was reported in low-income regions. A significant positive correlation was found between the prevalence of IPA and HDI (r = 0.446, P < 0.0001) in Asia (r = 0.334, P < 0.05) and Africa (r = 0.446, P < 0.05).

In some countries such as the United States, Finland, and Canada, the standard physical activity in adults has been monitored for several decades (19, 20). The Asia-Pacific region covers a spectrum of diverse and predominantly low-income countries (LMICs) from large and densely-populated states in Asia to small Pacific Islands. Considering the dramatic rise of NCD in this region, risk factors, including physical activity, should be closely monitored (21, 22).

In the developing countries outside the Asia-Pacific region, there is a similar situation with regard to measures of physical activity monitoring. In two Brazilian studies that employed IPAQ Multiple Domain Questionnaire, the incidence of IPA was estimated at 41.1% in Brazil (23) and 26.1% in a national sample (19). According to the results of another study in Brazil, the incidence of activity during leisure time was only 3% in adults (24). Similarly, in Saudi Arabia, the incidence of physical inactivity was estimated at an alarming rate of 96% (25).

The physical activity transfer program is a theoretical paradigm that manifests the link between the incidence of physical inactivity and higher levels of economic and social development in a country. This can be explained in terms of occupational shifts from high-activity to low-activity occupations (26).

Development is characterized by an economic shift from the agricultural-based economy, including changes in the occupational structure, the level of urbanization, and lower levels of work-related and domestic activities. Katzmarzyk and Mason argue that changes in daily work, social climate, and the nature of work (particularly outdoor activities) have contributed to the sedentary behaviors and constrained pattern of disease from communicable to chronic illnesses. In addition, economic changes may lead to lower levels of physical activity (27). Guthold et al. evaluated the outcomes of physical activity in 22 African countries, reporting a linear relationship between the level of urbanization in a country and the physical inactivity of its population. In other words, increased urbanization has diminished the level of physical activity (28).

Research shows that higher-income groups can increase leisure-time activities by diminishing work-related activities (29). However, low-income groups have to deal with decreased physical activity because they often lack the financial resources to engage in leisure activities. Nevertheless, lower-income groups that are more economically vulnerable maintain higher levels of physical activity at work and transportation compared to higher-income groups (30).

5.1. Conclusion

According to the results of this study, there is a significant correlation between HDI and the incidence of IPA. Therefore, considering factors that can influence the incidence of IPA in different countries can be helpful in reducing its incidence rate. By curbing the prevalence of IPA, the risk factors for non-communicable diseases could be reduced. Monitoring the current level and trend of IPA to track the extent of progress toward this global goal is essential to identify high-risk populations, assess the effec-

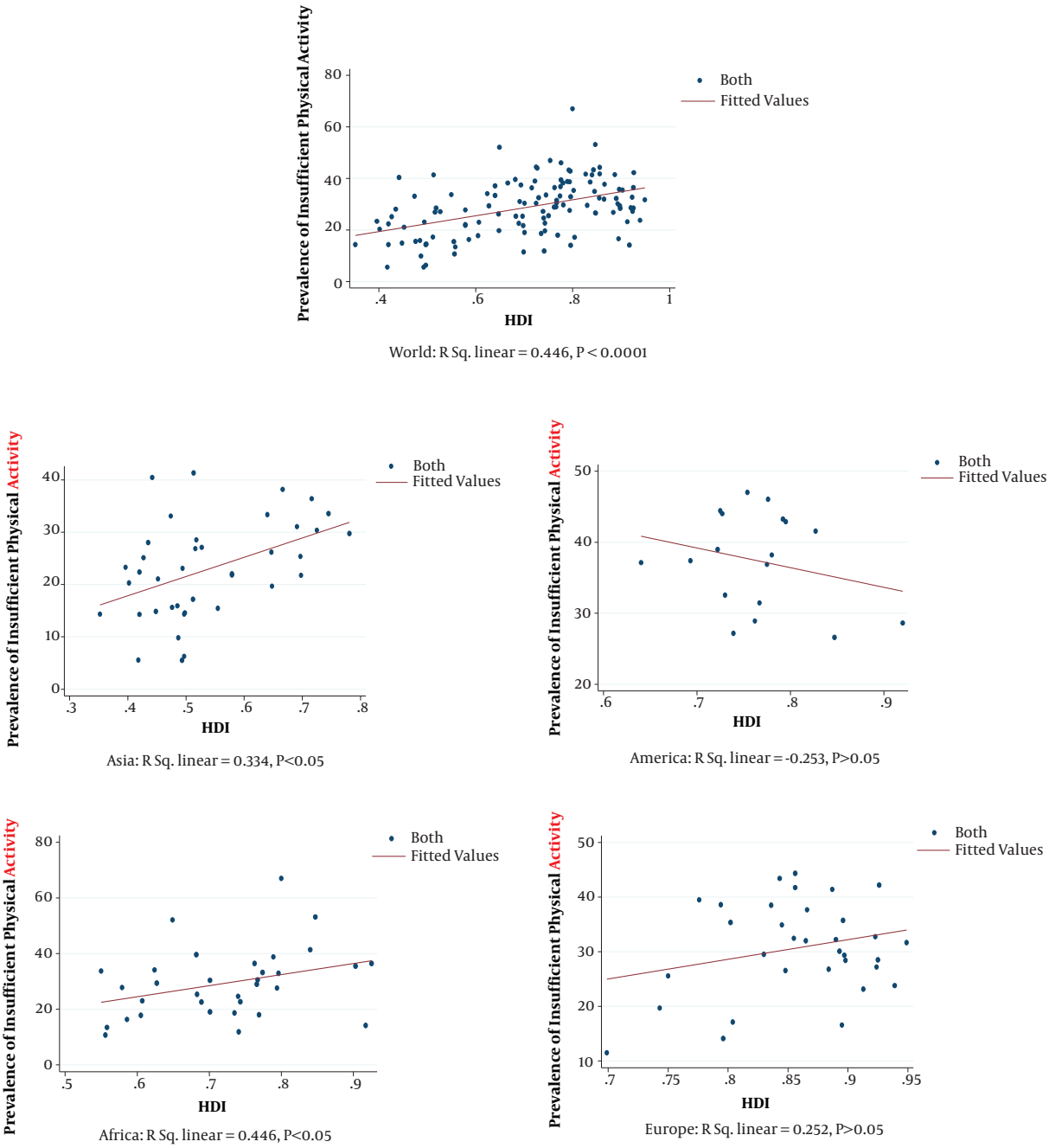


Figure 3. Correlation between HDI and the incidence of IPA in the world for each continent in 2016

tiveness of policies, and guide policy-making and future planning.

Footnotes

Conflict of Interests: The authors have no conflict of interest to declare.

Ethical Approval: The ethic approval cod is IR.KMU.REC.1398.505.

Table 3. Pearson Correlation Between HDI and the Dependent Variable[a]

HD Components	Pearson Correlation Between HDI Component and Dependent Variable					
	Both		Male		Female	
	r	P	r	P	r	P
Gross national income per 1000 capita	0.410	< 0.0001	0.491	< 0.0001	0.343	< 0.0001
Mean years of schooling	0.304	< 0.0001	0.374	< 0.0001	0.228	< 0.001
Life expectancy at birth	0.418	< 0.0001	0.473	< 0.0001	0.352	< 0.0001
Expected years of schooling	0.315	< 0.0001	0.393	< 0.0001	0.235	< 0.0001

[a] Dependent variables: Prevalence of IPA

Table 4. Mean IPA in Different HDI Regions in 2016[a]

HDI Components	Mean IPA (%)		
	Both	Male	Female
Very high human development	35.5 ± 1.09	30.24 ± 8.7	37.05 ± 12.1
High human development	31.7 ± 9.17	21.15 ± 7.7	36.21 ± 11.5
Medium human development	26.3 ± 9.9	21.03 ± 8.5	32.14 ± 12.2
Low human development	20.3 ± 9.6	16.7 ± 8.4	23.79 ± 11.1
P (F-test)	< 0.0001	< 0.0001	< 0.0001

[a] Statistical method: ANOVA

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Table 2. Prevalence of IPA Among Adults Aged +18 Years (Age-Standardized Estimate) Worldwide by Countries in 2016 (Source: WHO)

Country	Prevalence (%)			Country	Prevalence (%)		
	Both	Male	Female		Both	Male	Female
Asia				**Africa**			
Kuwait	66.96	61.34	74.64	Egypt	31.02	23.23	38.79
Jordan	11.87	10.33	13.5	Libya	36.4	31.2	41.54
United Arab Emirates	41.35	38.96	49.35	South Africa	38.17	28.47	47.26
Saudi Arabia	53.14	44.91	65.1	Tunisia	30.36	26.42	34.1
Israel	–	–	–	Morocco	26.2	20.75	31.35
Qatar	36.83	33.16	48.7	Mauritius	29.77	27.63	31.82
Bahrain	–	—	–	Algeria	33.58	26.92	40.25
West Bank and Gaza Strip	–	–	–	Swaziland	–	–	–
Syrian Arab Republic	–	–	–	Gabon	25.33	17.67	33.19
Lebanon	36.41	39.8	32.97	Cameroon	28.51	21.75	35.18
Iraq	52.03	39.46	64.56	Mauritania	41.31	36.53	46.07
Turkey	30.56	21.74	38.8	Djibouti	–	–	–
Kazakhstan	27.5	26.1	28.74	Cabo Verde	19.68	14.09	24.99
Oman	32.95	30	40.19	Zimbabwe	26.84	22.77	30.68
Uzbekistan	19.06	13.3	24.42	Botswana	21.74	17.11	26.3
Georgia	17.96	17.25	18.58	Namibia	33.36	28.89	37.4
Azerbaijan	–	–	–	Equatorial Guinea	–	–	–
Iran (Islamic Republic of)	33.22	23.06	43.38	Lesotho	6.25	6.52	6
Armenia	22.64	23.34	22.09	Nigeria	27.1	24.7	29.57
Turkmenistan	–	–	–	Ghana	21.8	18.6	24.84
Kyrgyzstan	13.88	10.86	16.74	Côte d'Ivoire	33.06	29.06	37.28
Mongolia	18.6	17.77	19.39	Benin	15.89	13.61	18.11
Malaysia	38.75	34.64	42.79	Sierra Leone	14.29	10.15	18.29
Yemen	–	–	–	Senegal	23.09	17.56	28.12
Darussalam Brunei	27.34	21.78	33.89	Guinea	14.5	10.61	18.38
Singapore	36.5	34.3	38.61	South Sudan	–	–	–
Republic of Korea	35.35	29.55	40.99	United Republic of Tanzania	6.49	5.8	7.15
Japan	35.47	33.84	39.89	Liberia	25.12	21.72	28.5
Tajikistan	29.32	19.95	38.68	Sudan	–	–	–
China	14.11	15.96	12.19	Comoros	14.32	9.63	19.01
Maldives	30.33	25.77	34.78	Congo	28.03	24.76	31.27
Thailand	24.58	21.79	27.25	Uganda	5.52	5.2	5.82
Philippines	39.66	30.13	49.08	Somalia	–	–	–
Bhutan	22.98	17.7	29.46	Mozambique	5.56	5.05	6.02

	Democratic People's Republic of Korea	35.35	29.55	40.99	Angola	–	–	–
	Pakistan	33.65	24.38	43.3	Guinea-Bissau	–	–	–
	Sri Lanka	28.95	20.23	36.75	Kenya	15.44	13.93	16.93
	Indonesia	22.57	23.46	31.96	Togo	9.8	9.23	10.34
	India	34.03	24.7	43.89	Malawi	15.61	12.99	18.17
	Lao People's Democratic Republic	16.27	11.7	20.65	Gambia	21.07	15.98	25.85
	Nepal	13.4	12	14.61	Rwanda	14.56	11.02	17.58
	Myanmar	10.72	8.13	13.14	Mali	40.42	33.73	47.1
	Timor-Leste	17.79	10.26	25.48	Burundi	–	–	–
	Afghanistan	–	–	–	Chad	23.3	19.62	26.93
	Cambodia	–	–	–	Zambia	22.06	19.08	24.97
	Viet Nam	25.39	19.9	30.56	Central African Republic	14.31	12.6	15.94
	Bangladesh	27.76	16.13	39.46	Niger	22.38	19.72	25.02
America					Madagascar	17.17	12.83	21.41
	Puerto Rico	–	–	–	Burkina Faso	20.3	17.74	22.72
	United States of America	40.01	31.72	48.02	Eritrea	22.37	13.77	30.71
	Argentina	41.58	37.62	45.25	Democratic Republic of the Congo	23.85	20.83	26.78
	Canada	28.6	25.72	31.38	Ethiopia	14.86	11.34	18.28
	Mexico	28.89	25.47	32.19	**Europe**			
	Bahamas	43.26	30.04	55.58	Czech Republic	–	–	–
	Belize	–	–	–	Malta	41.75	36.21	47.25
	Chile	26.58	24.42	28.65	Spain	26.81	22.87	30.52
	Barbados	42.9	29.29	54.95	Cyprus	44.35	38.38	50.53
	Venezuela (Bolivarian Republic of)	31.43	29.49	33.31	Luxembourg	28.43	26.42	30.43
	Trinidad and Tobago	38.18	27.21	48.65	Germany	42.21	40.18	44.13
	Uruguay	22.42	18.74	25.72	Ireland	32.73	28.26	37.08
	Costa Rica	46.06	37.68	54.32	Hungary	38.54	33.13	43.3
	Panama	–	–	–	Slovenia	32.22	27.69	36.61
	Suriname	44.43	38.13	50.62	Poland	32.46	31.48	33.36
	Nicaragua	–	–	–	United Kingdom	–	–	–
	El Salvador	–	–	–	Portugal	43.4	37.55	48.48
	Paraguay	37.42	38.06	36.76	Serbia	39.46	34.82	43.78
	Ecuador	27.18	24.6	29.7	Lithuania	26.53	23.22	29.23
	Brazil	47.02	40.37	53.28	Belgium	35.75	30.63	40.62
	Colombia	44.01	38.78	48.93	Slovakia	34.9	31.14	38.36
	Peru	–	–	–	Finland	16.56	17.19	15.96
	Guatemala	37.12	37.12	37.13	Bosnia and Herzegovina	25.54	22.8	28.05

	Dominican Republic	38.97	34.43	43.38	Austria	30.09	26.43	33.57
	Honduras	-	-	-	Iceland	-	-	-
	Cuba	36.88	30.95	42.79	Croatia	31.09	25.87	35.83
	Bolivia (Plurinational State of)	-	-	-	Switzerland	23.75	21.71	25.71
	Guyana	-	-	-	Italy	41.39	36.17	46.23
	Jamaica	32.56	28.37	36.62	Greece	37.66	33.93	41.4
	Haiti	-	-	-	Bulgaria	38.63	35.58	41.44
Oceania					Montenegro	-	-	-
	Samoa	12.58	8.21	17.19	Latvia	29.54	25.35	32.94
	Australia	30.37	27.04	33.64	France	29.32	24.26	33.99
	New Zealand	42.38	39.27	42.25	Russian Federation	17.12	16.55	17.6
	Solomon Islands	18.2	13.25	23.17	Netherlands	27.18	25.29	29.01
	Vanuatu	8	7.21	8.78	The former Yugoslav Republic of Macedonia	-	-	-
	Fiji	17.41	10.85	24.09	Norway	31.7	29.58	33.83
	Papua New Guinea	14.8	11.44	18.22	Albania	-	-	-
					Sweden	23.13	21.51	24.73
					Belarus	14.08	13.68	14.42
					Romania	35.35	32.1	38.32
					Estonia	31.99	28.86	34.64
					Denmark	28.5	25.73	31.19
					Ukraine	19.63	18.68	20.42
					Republic of Moldova	11.48	12.13	10.9